Junior Lab

Ground a.k.a. Earth

Household Ground

Mostly you are familiar with ground in its household use. The three-wire grounded 120 VAC 60 Hz receptacle has hot (black wire, smaller blade) neutral (white wire, larger blade) and Ground (green wire, round connector). The hot is at 120 VAC, while the neutral is at 0 VAC and the ground is close to 0 VAC. In a properly working device all the current is carried by the hot and neutral. Typically in house hold use up to 10 to 15 Amps can be supplied before a fuse or circuit breaker blows (easily enough to kill you or your cat). The ground is electrically tied to the neutral, not in the device you are using (very bad), but typically at the fuse box (but often here to the receptacle box). Basically, this provides a return path for current in the event of some mistake. Typically the out side handle or chassis of the device is ground.

Science Lab Ground

In scientific labs, equipment has the safety ground, also often called chassis ground (because the chassis of most equipment is attached to it). But typically there is also another ground, called signal ground. This is set of wires that define 0 volts for the measurement circuit. For example often the shield of a BNC cable is tied to signal ground. In complicated experimental set-ups, one should be very careful about distinguishing between chassis and signal ground. More over, the details of how to attach signal grounds between different devices, such as amplifiers and filters, is not trivial. Ground loops can wreak havoc in many experiments. Typically the signal ground is attached (grounded) to the chassis ground at only one point.

Our Pasco High-Voltage Amplifier

Look over the spec's for this equipment. (They are in the cleat envelope on the top.) The green/yellow banana connector is the chassis ground and it is connected to the safety ground in the three-prong plug.

On the high-voltage side (sort of the "signal" end) none of the outputs are grounded –they are floating. That is there is no well-defined voltage between one of these outputs and chassis ground. (Note there are three outputs. This is because the transformer used has a center tapped output.) This amplifier we can ground any **ONE** of these outputs, *i.e.* attach **ONE** of these outputs to the chassis ground at the back. This then sets the voltage reference to the outside world. For example, with the high-voltage full on if we ground the left connector the middle and right connectors are at 3 and 6 kV, respectively; if we ground the middle connector (center tap) the left and right connectors are at –3 and 3 kV, respectively; and if we ground the right connector the left and middle connectors are at –6 and –3 kV, respectively. Now you can put well defined + and – charges onto the spheres.

It is important to only ground ONE of the outputs.